# Mechanical Test

***Compression testing*** is a type of mechanical testing that involves applying a compressive force to a material and measuring its response. The compressive force tends to reduce the size of the material.

During a compression test, a sample or specimen of the material is placed in a testing machine, where it is compressed between two plates. The machine applies a gradually increasing load to the specimen, and the deformation or change in the material's dimensions.

Moreover, compression testing can reveal the material's behavior under compressive stress, including whether it fails by cracking (brittle failure), deforming plastically (ductile failure), or some combination of the two. This information compression testing can be used in material selection, quality control, research and development, and failure analysis.

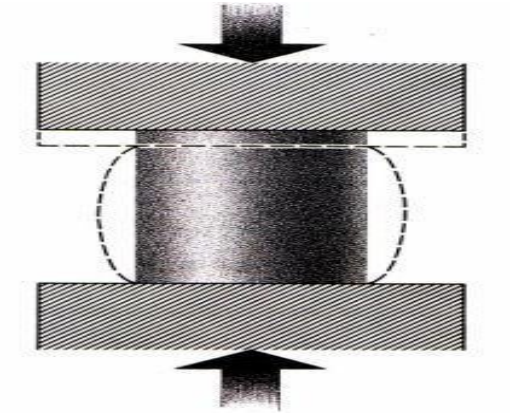

**Figure 1.** Compression test of ductile material.

Because the compression test increases the cross-sectional area of the sample, necking never occurs.

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***tension testing***, is a fundamental materials science and engineering test in which a sample is subjected to a controlled tension until failure. Properties that are directly measured via a tensile test are ultimate tensile strength, breaking strength, maximum elongation and reduction in area. From these measurements the following properties can also be determined: Young's modulus, Poisson's ratio, yield strength.

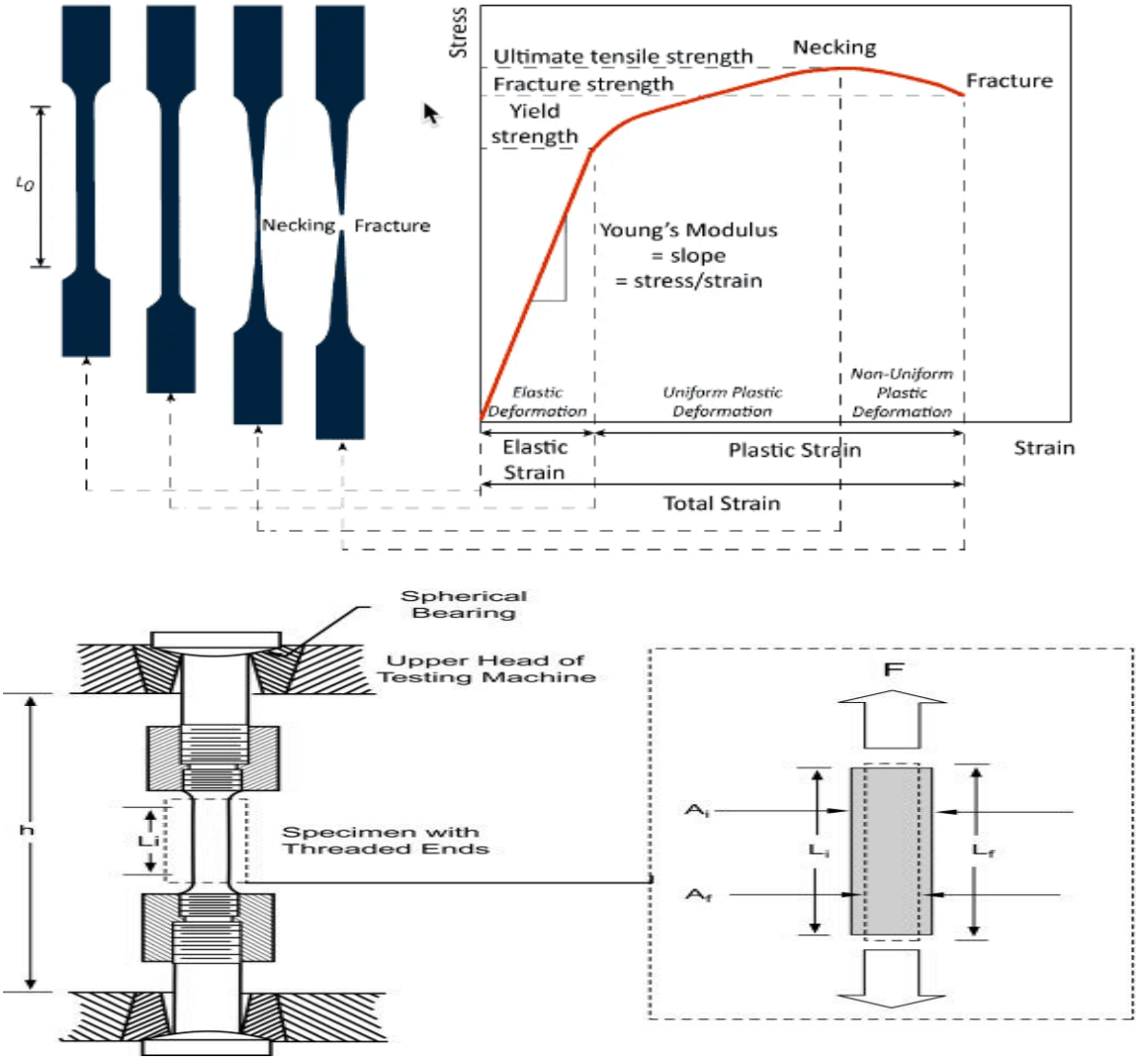


**Figure 2.** Tensile testing machines.

The explanation of tensile test data requires skill accepted from experience, since many factors can affect the test results, the temperature at which the test is carried out, since the tensile modulus and tensile strength decrease as the temperature rises for most metals and plastics, while the ductility increases as the temperature rises. The test results are also influenced by the rate at which the specimen is strained.

***Hardness Testing,*** has already been defined as the resistance of a material to indentation or abrasion by another hard body (good hardness generally means that the material is resistant to wear).

- ***The Brinell Hardness Test***

In this test, hardness is measured by pressing a hard steel, tungsten and cemented carbide ball (usually 10 mm in diameter) into the surface of the test piece, using a known load. It is important to choose the combination of **load** and **ball size** carefully so that the indentation is free from distortion and suitable for measurement. The relationship of the Brinell hardness [$\mathbf{H_B}$] which is between load ***P*** (kg), the diameter ***D*** (mm) of the hardened ball indenter and the diameter **d** (mm) of the indentation on the surface

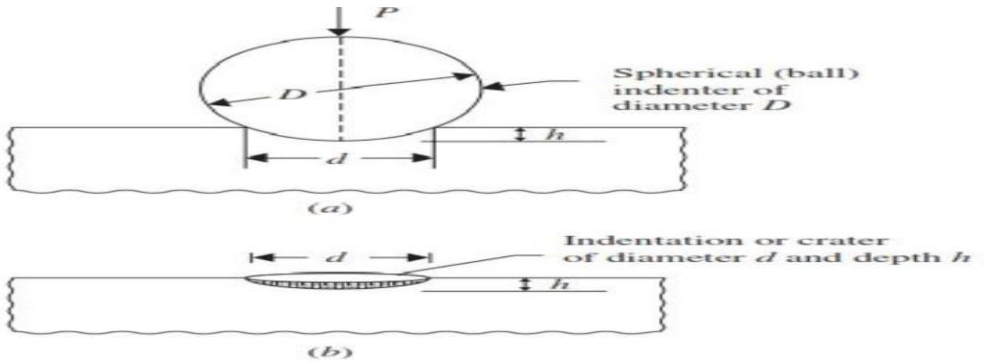


**Figure**3. Principle of the Brinell hardness test.

- ***The Vickers Hardness Test***

This test is uses a diamond indenter. Diamond is the hardest material known - approximately 6000 HB. The diamond indenter is in the form of a square-based pyramid with an angle of 136˚ between opposite faces.

Since only one type of indenter is used, the load has to be varied for different hardness ranges. Standard loads are (5, 10, 20. 30, 50 and 100) kg. It is necessary to state the load when specifying a Vickers hardness number. For example, if the hardness number is found to be 200 when using a 50 kg load, then the hardness number is written as HV (50) = 200.

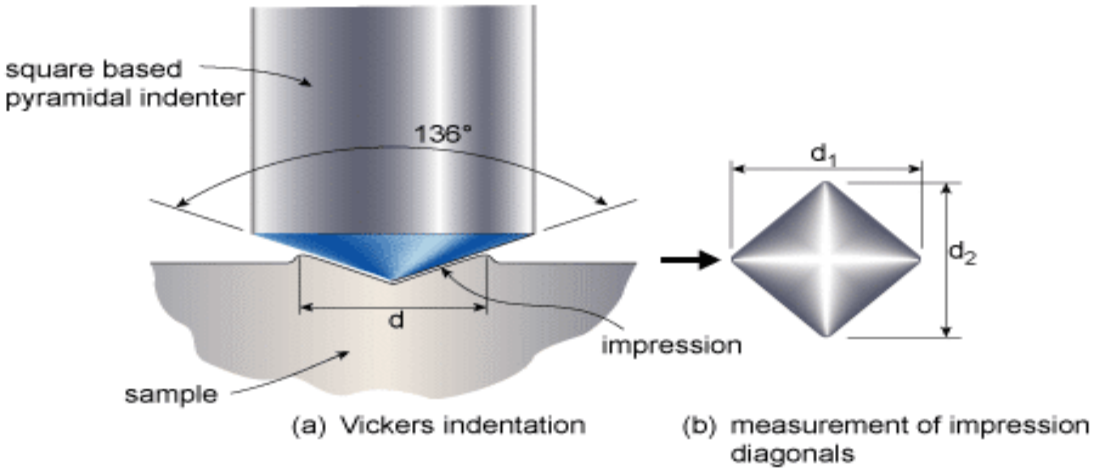


**Figure 4.** The Vickers hardness test method

- ***The Rockwell Hardness Test***

The Rockwell hardness test uses a small-diameter steel ball for soft materials and a diamond cone, or Brale, for harder materials. Therefore, it is widely used in industry as it is:

1.Quick and simple.

2.Direct reading.

3.Freedom from personal error.

4.Ability to distinguish small hardness difference.

5.Small size of indentation, and

6.They are so simple to perform.

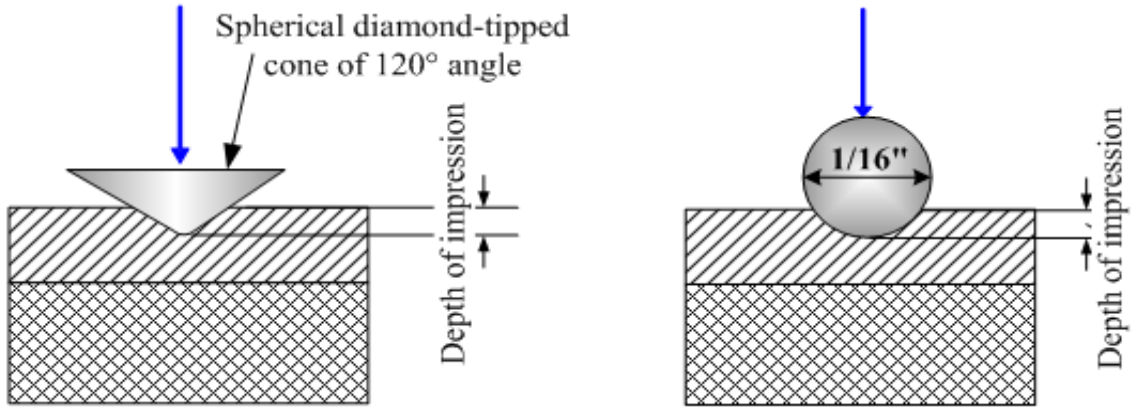


**Figure 5.** The Rockwell hardness test.